

Fifty years of oceanography in the Department of Mineralogy, British Museum (Natural History)

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Introduction

The study of oceanography in the Department of Mineralogy in the British Museum (Natural History) began in a somewhat tortuous way. From the nineteenth century most of the rocks collected by the early voyages of exploration and scientific investigation would ultimately have been presented to the Museum. Although its staff had little or no involvement in these expeditions, the policy of presenting biological and geological collections to the Museum continued during the period following the classic voyage of HMS *Challenger*, 1872–76 (see p. 87), and between the two World Wars. At this time the British oceanographical effort tended to be associated with the investigation of Antarctica, generally centred on the study of whales and their environment, in the RRS *Discovery*, *Discovery II* and *William Scoresby* (Deacon, 1984).

The establishment of an Oceanography Section in the Department of Mineralogy began with the acquisition from the Department of Zoology in 1935 of the Sir John Murray Collection, which included much of the extensive collections of zoological, botanical and geological specimens made by HMS *Challenger* (Lingwood, 1981) (Plates 1–2). The *Challenger* collection in the Section contains only sediments and the relatively few rocks that were taken. This paper does not attempt to give an account of the *Challenger* expedition, or of its collections; for this the reader is referred to Linklater (1972).

In succeeding pages the history of how the Sir John Murray Collection came to the Museum is traced, followed by a brief account of the John Murray Expedition to the Indian Ocean, financed by income from the Christmas Island Phosphate Company. The establishment of the Oceanography Section in the Department of Mineralogy follows, with an account of the birth of the National Institute of Oceanography. Two aspects particularly link the early days of the NIO with the Museum: the involvement of John Wiseman in its planning stages, and the



Plate 1 HMS *Challenger* at anchor in the outer harbour of St Thomas, Danish West Indies.

work of N. A. Mackintosh and the Whale Research Unit in the Museum's grounds. The development since the war of the Oceanography Section is described and some of the more interesting items in the collection are mentioned. A brief summary of the major research activities of the Section is given, with selected references, and finally, an account of the Antarctic expeditions as an appendix. In the case of the Antarctic collections, references to research conducted outside the Section and outside the Museum are provided in the catalogue references frequently quoted.

The Sir John Murray Collection

Sir John Murray, KCB,¹ who was knighted in 1898 (Herdman, 1923), was one of the naturalists on the four year (1872–76), 111 110 km voyage of HMS *Challenger* with Captain G. S. Nares and Professor C. Wyville Thomson, whose natural successor he was to become. He was a candidate in 1881 for the first Directorship [Superintendentship] of the British Museum (Natural History), but was considered too forthright in his manner by the Archbishop of Canterbury and the other Trustees: the post went to Richard Owen. Murray now worked, in collaboration with the Belgian, Abbé Renard, on the sediment sounding samples which formed the bulk of the *Challenger* deep-sea deposits and were in his charge (Plate 3). Their report (Murray & Renard, 1891) was one of the 50 volumes or part volumes, of which Murray wrote seven, which described the voyage. During this time, the collection was housed at the Challenger Expedition Commission's Office at 32 Queen Street, Edinburgh. In 1890 the Office moved to 45 Frederick Street and presumably the collection went with it, until this second office was given up in about 1904. In this year Murray bought the Villa Medusa (M. Deacon, in prep.). Meanwhile, in 1897, Murray had acquired as his residence Wardie Lodge, in Wardie, Granton, a northern suburb of Edinburgh, and changed its name to Challenger Lodge – it is

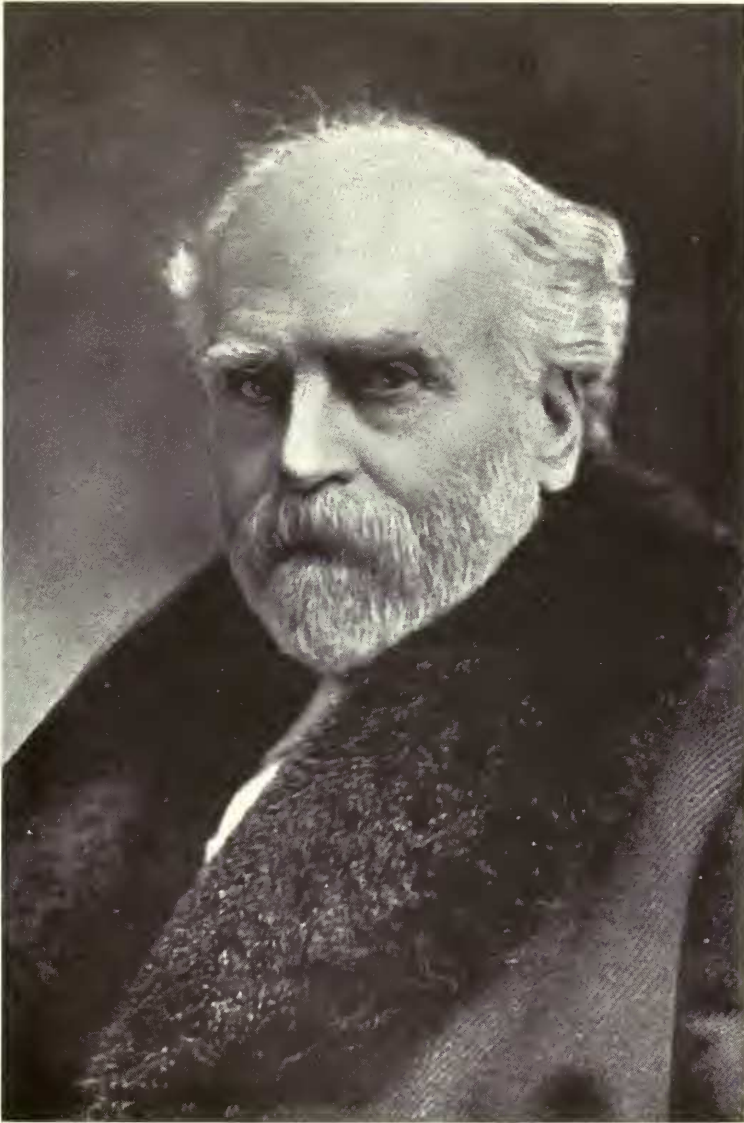


Plate 2 Sir John Murray.

now St Columba's Hospice (Plate 4); the Villa Medusa was just across the road (Plate 5). It was here that Murray and Mr James Chumley, formerly Sir John's secretary for many years, and in whose care lay the curation of Murray's whole collection, which included many specimens other than those collected by the *Challenger*, transferred the entire collection in 1904. Here it stayed until 1922, when the house was sold, the year after the collection was acquired by the British Museum (Natural History). The name, however, was transferred to another house further up the road, which became 'Medusa Cottage'.

Murray was killed near Edinburgh in a motor accident on 16 March 1914, leaving a widow, two daughters and the two sons, John Challenger and Thomas Henderson. Shortly before this, however, he was visited by Edward Heron-Allen, to seek his advice and to discuss the disposal of the collections in the event of his death. Initially, he had intended to leave them all to his two sons, whom he hoped would carry on his work. Later, however, he had 'been made aware

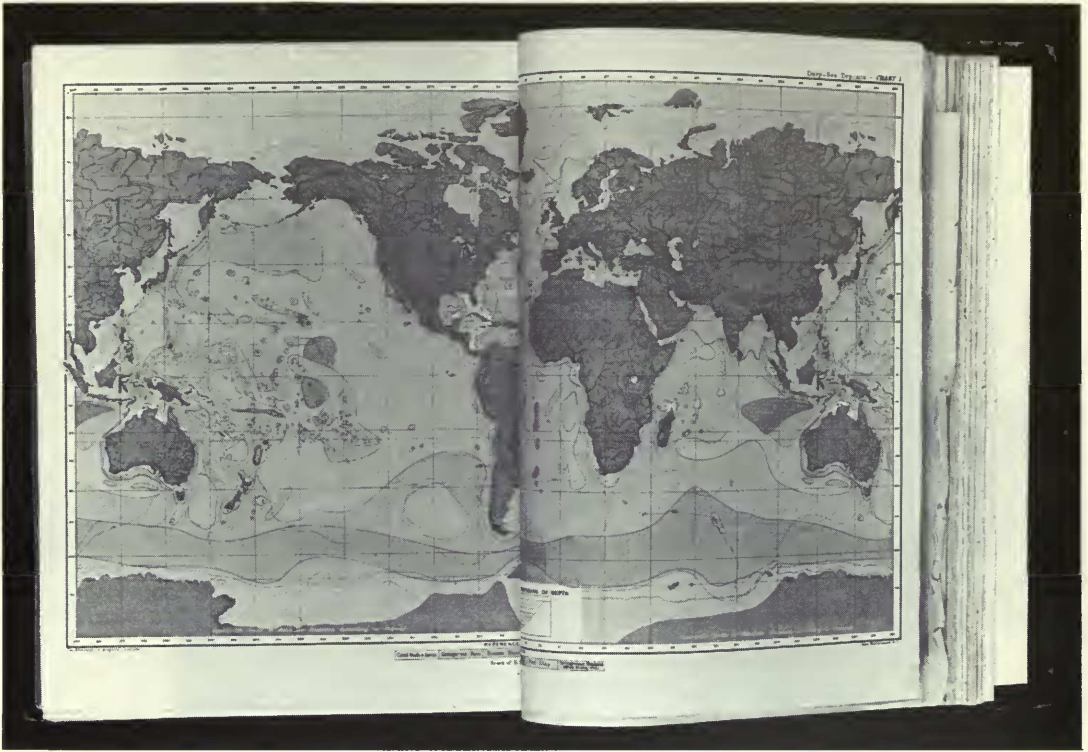


Plate 3 The distribution map of marine deposits from Murray & Renard (1891).

that his sons' tastes and feelings lay in other directions'; therefore he would have to make other arrangements for their disposal. After lengthy discussions he decided that the collections should go either to the British Museum (Natural History) or to the Imperial College of Science [University of London], where they would be put in charge of a responsible curator whose first duty would be to catalogue and index every sample. Murray planned to set up a fund for the curator, to 'make it worthwhile', and to leave a legacy to cover the removal expenses. However, he died before any of this could be arranged. Chumley, now a Demonstrator in Zoology in the University of Glasgow, continued to make repeated visits to the Villa to keep it and the collections in order.

Chumley wrote to Edward Heron-Allen on 8 April 1914² concerning the trust fund Sir John Murray had planned for oceanographical research. Chumley had had a long talk with Lawrence Pullar, a lifelong friend and trustee of Murray's estate; Pullar had said that no precise instructions had been left in his will. J. C. Murray and his mother, Lady Murray, wondered whether Sir John had confided his intentions to Heron-Allen. The next day Heron-Allen wrote to Pullar concerning the disposal of the collection, mentioning that Sir John's two sons had had a change of heart concerning oceanography, leading to Sir John's plan to set up the fund to provide income sufficient to make it worth while for a curator to look after the collection.³ Replying to Heron-Allen on 10 April,⁴ Pullar enclosed notes on what he considered Sir John had in mind for the collection. Since his sons were under age, the problem of the disposal of the collection would have to wait until they came of age.

This is the background to the lengthy report of 28 pages, dated 21 January 1920⁵ and written by Heron-Allen (who referred to himself as 'one of your reporters') and his assistant, Arthur Earland, of the British Museum (Natural History), where they worked on recent foraminifera. It was written at the request of the Director, Sir Sidney (Frederic) Harmer, who was also Keeper of Zoology, and described the contents of the Villa Medusa. The reason for the delay –



Plate 4 Challenger Lodge. Formerly Wardie Lodge, now St Columba's Hospice, northern Edinburgh.

from 1914 to 1919, almost a full five years – had perhaps been made clear in a letter to Sir Sidney Harmer from Lady Murray, Sir John's widow, dated 12 June 1919.⁶ Lady Murray was replying to a letter from Sir Sidney, dated 7 June,⁷ in which he stated that he had recently met the Hydrographer of the Navy, Admiral Sir John (F.) Parry, and was enquiring whether the Museum might acquire the collection. Lady Murray stated that her sons would be responsible for the collection 'when my youngest boy comes of age next September'. Almost at once the older, J. C. Murray, also wrote to Sir Sidney, on 15 June 1919,⁸ requesting a meeting to discuss the disposal of the collection. He mentioned that his father had 'desired that the whole collection should be kept together and not split up into different parts. And I remember that this is what he was afraid would happen if they were sent to the British Museum . . .'. Harmer replied on 20 June, suggesting they should meet, with Charles Edward Fagan, previously Assistant Secretary and now Secretary of the Museum, at the Museum on 8 July 1919.⁹ Their meeting was followed by a visit, proposed by Murray,¹⁰ by Sir Sidney to the Villa Medusa, 'just opposite my mother's house, Challenger Lodge', on 14 July, where he met Chumley and inspected the collection. Heron-Allen also met Murray, and on 26 November Murray wrote to Harmer expressing the hope that Heron-Allen would be able to visit the Villa, perhaps on 8 December, to meet Chumley and examine the collection.¹¹ In a preliminary report to Trustees, dated 14 November 1919,¹² Harmer discussed his July visit and recommended that the offer of Heron-Allen and Earland to inspect the collection be taken up. It was agreed that the visit should take place and on 22 November Harmer wrote to Murray and Heron-Allen to make the arrangements for the visit; Heron-Allen and Earland would travel up on the night of 7 December and visit the Villa the next day.¹³ There was then some doubt as to whether Chumley would be there or not; Harmer wrote again on 4 December¹⁴ saying that the visit should take place in any case and this is how it turned out.



Plate 5 The Villa Medusa: 14/16 Boswall Road, Wardie, Granton. The house is almost opposite Challenger Lodge. Note the 'Deposit Room', on the first floor, with the bow window.

Heron-Allen and Earland found the Villa Medusa to be a large semi-detached house, No. 14 Boswall Road (M. Deacon, in prep.).¹⁵ The main room was a 'large and lofty first-floor room known as the Deposit Room' (Plate 6); it had a bow window and contained the 'soundings and dredgings' from the Challenger Expedition, together with smaller collections. The *Challenger* material, arranged in bottles and boxes on ten shelves, occupied a total of 51.5 m of shelving. The remainder, collected by at least 36 survey and cable ships, mostly British but with some from the United States of America and at least one from Russia, spanned the world and included miscellaneous collections of phosphates, glauconite, nodules and other materials. The largest collection by one ship occupied 10 m of shelving, with several occupying less than 30 cm; they totalled some 91 m. It is interesting to note that until 1868 all survey ship collections were stored by the Geographical Survey. They were acquired by Sir John Murray when he formed his collection and include the early cable ship collections from the Atlantic and Indian Oceans, of great historical interest. The rest of the Villa was also used to house the library, apparatus and miscellaneous items, with a ground floor laboratory. Two outbuildings in the garden to the rear – a two-room Chemical Laboratory and a large shed – were also utilized.

It was recommended by Heron-Allen and Earland that the oceanographic equipment and the Scottish Lakes Survey specimens should be donated to the University of Edinburgh for its projected Marine Biological Station [Department of Oceanography]. The 'Philosophical Instruments and Apparatus' should go, as most eventually did, to the 'Scientific Apparatus Collection' [Science Museum] at South Kensington, London, the remainder coming to the British Museum (Natural History).

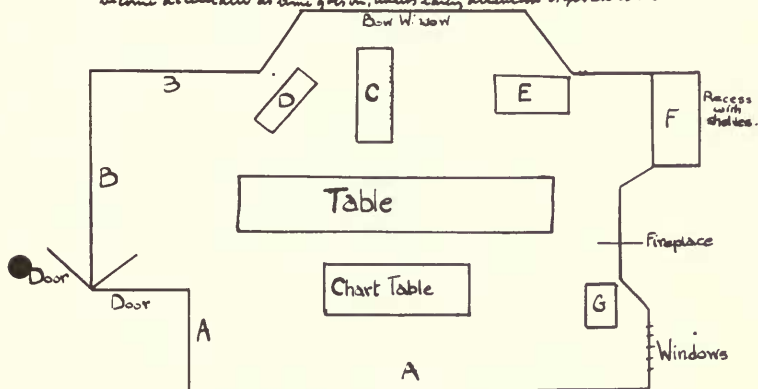
They found the collection in good condition, although some of the labels were becoming defaced or illegible. They recommended that all the main collection of 9746 Marine Deposits,

Report on oceanographical collection - Sir John Murray.

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2. THE OCEANOGRAPHICAL COLLECTIONS

The principal Oceanographical collections at Villa Medusa are in a large and lofty first-floor room known as the Deposit Room, a rough plan of which is here given; not to scale. The collections appear to be in good condition at present, but in some cases the labels are becoming defaced or illegible and this deterioration is likely to become accelerated as time goes on, unless early attention is given to the matter.



- AA. Challenger Oceanic Deposits.
- BB. Other Survey Ships.
- C. Double fronted case of shelves, 7 ft. by 6 ft by 1 ft, packed solid with small samples of deposits from Survey and Cable ships.
- D. Oak Specimen cabinet with 18 drawers, two deep, the rest shallow. About 3 ft. by 3 ft. by 1½ ft. deep, empty at present.

Plate 6 Plan of the 'Deposit Room', from Heron-Allen and Earland's report.⁵

soundings, etc., together with the library, including the *Challenger* expedition glass photographic plates, and the microscopical preparations, should go to the British Museum (Natural History), to form the basis of the Oceanographical Collections. They recommended the employment of a Curator who, whilst needing some specialist knowledge, would not be engaged full-time on the collection. His main tasks would in future be to '[receive, register and arrange] such further material from Cable Companies and other bodies', while the 'Admiralty would no doubt be glad to supply the material collected by its Survey ships, and thus in time the Collections would assume a world-wide importance and become of great commercial utility'; after the Second World War, the Admiralty did indeed agree to donate their sounding samples to the Museum.

On 23 December Dr Charles Tate Regan, later to become Keeper of Zoology in the British

Museum (Natural History), wrote to the Director of the Museum informing him that the visit of Heron-Allen and Earland to the Villa Medusa had alerted the University of Edinburgh, who might now try to persuade Lady Murray to give them the collections.¹⁶ So when, on 4 January 1920,¹⁷ Lady Murray wrote to Harmer saying that her sons were 'finding it hard to know what is best to do' with the collection, the Director was in no doubt. On 10 January¹⁸ he wrote to Dr Arthur Smith Woodward, Keeper of Geology, telling him that the Museum might be offered the collection and asking him his opinion on whether it should accept; if so, should it be amalgamated with the 'duplicate' *Challenger* specimens, one from each station, presented to the Department of Geology by Sir John Murray on 6 March 1895. Woodward replied in the affirmative,¹⁹ speaking also on behalf of his successor, Dr Francis Arthur Bather, and saying that they thought the collection should not be subdivided. As will be seen, the collection came in fact to the Department of Zoology, the 'duplicates' being transferred to Zoology on 6 October 1922 and finally to the Department of Mineralogy in 1938.

By now – 12 January – Professor J. H. Ashworth of the Department of Zoology, University of Edinburgh, had written²⁰ asking for the duplicate *Challenger* and *Knight Errant* specimens for their proposed new Department of Oceanography. Ashworth seemed nevertheless happy that the main collection should go to the British Museum (Natural History) and Harmer mentioned this in his report to Trustees of 19 January 1920.¹⁵ He recommended that the two reporters – Heron-Allen and Earland – should be warmly thanked and made it clear that he considered the collection of 'marine deposits and animals' should come to the Museum on the recommendations of their lengthy report, formally dated 21 and 24 January and submitted to Trustees on 20 January.²¹ He added that Sir John Murray's wish to donate money to pay for a curatorship of the collection had never been carried out. Finally, he also mentioned that the initiation of a Department of Oceanography at Edinburgh was under consideration.

Also on 20 January,²² J. C. Murray wrote to Fagan to ask if any date had been fixed for the removal of the collection: his mother was selling her house – Challenger Lodge – and also part of the grounds of the Villa Medusa. He also suggested that James Chumley be employed at the Museum to curate it. On 30 January, the Director wrote to Lady Murray saying that Trustees would welcome an offer from her and her family to present a substantial part of Sir John's collections to the Museum.²³ They were consulting the Admiralty, through the Hydrographer, Admiral Parry, to ascertain their views, and felt that the proposed acquisition would 'appropriately form the nucleus of a great collection illustrating Oceanography in the British Museum (Natural History)'. If such an offer was made, the Trustees would endeavour to find suitable accommodation for the collection and 'use their best efforts to place it in the charge of a suitable Curator', subject to the consent of the Treasury for the new expenditure. Harmer ended by saying that Lady Murray would be very welcome at the Museum should she wish to discuss these matters further. Also in the letter were paragraphs repeating the recommendations of the reporters for the donations to the University of Edinburgh and the Science Museum. Lady Murray replied on 31 January²⁴ saying – rather surprisingly – that her sons were deciding what to do with the collection. On 2 February²⁵ J. C. Murray wrote to Harmer, requesting a meeting; he wrote again on 4 February 1920 erroneously regretting the news that Fagan had died (he died early in 1921) and making mention of accommodation in the British Museum proving difficult: he would ask the other trustees of his father's estate about a curator for the collection.²⁶

Matters began to be resolved in the middle of March, when J. C. and T. H. Murray wrote on 18 March²⁷ to the Director, offering the collection and listing the conditions under which the Sir John Murray Collection would be donated to the British Museum (Natural History). The Murrays' family solicitor may well have drawn up the list, which stated:

1. The Museum agrees to accept the John Murray library and sediment collection on condition they are kept together and known as the Sir John Murray Collection.
2. Additions can be made; indeed it is hoped that they will form the nucleus of a larger Oceanographical Department. The whole to be in the care of a suitable Curator.
3. Duplicates of books, etc, not required are to be returned to the Villa Medusa, Edinburgh.

In the Minutes of Standing Committee dated 24 March,²⁸ Trustees said that they accepted the conditions as written. On the recommendation of the Director to Trustees on 21 April, Fagan wrote formally to J. C. Murray on their behalf on 29 April 1920,²⁹ recording their acceptance of a month earlier.

Few things are quite so simple, however. The duplicate books, required by Condition no. 3 to be returned to Edinburgh, seem to have been included with the Museum collection. On 26 June Trustees were informed that Harvard University, Cambridge, Massachusetts, had requested Murray to return the *Albatross* specimens, belonging to them, which they had sent to Sir John Murray.³⁰ Also, C. E. Fagan, the Secretary, had to inform Trustees that the Assistant Secretary of the United States National Museum had requested the return of the USS *Tuscarora* samples, along with those from the *Thetis*, *Blake* and *Bibb*. The conditions of their donation to Sir John Murray were not known but it was clear that J. C. Murray had understood that they were his to keep. In his letter to Murray of 14 October 1921,³¹ Harmer stated that Chumley had admitted that the *Albatross* collection did belong to Harvard. Presumably these samples were returned, since they are no longer in the Museum collection, whilst some at least from the *Blake*, *Thetis* and *Bibb* are still in the British Museum (Natural History); nevertheless, on 16 October 1926³² a further request for their return was reported by Dr Tate Regan, Keeper of Zoology, to Trustees.

Whilst in late August to early September 1920 the British Association meeting in Cardiff was recommending a new *Challenger*-type expedition to investigate the oceans, there was difficulty, also, in finding accommodation for the new and important donation. An application dated 12 August 1920³³ to the Office of Works (now absorbed within the Department of the Environment) for the return by the Board of Education of the galvanized iron temporary building known as Block C was turned down in a reply to C. E. Fagan dated 9 September 1920.³⁴ A further letter to the Office of Works (20 October)³⁵ requested alternative accommodation; a reply on 1 December³⁶ somewhat reluctantly offered part of Block B (see p. 71) followed later in the month when a rough plan of the block (of 437 m²) was sent to the Department of Zoology.³⁷ The offer of this accommodation was accepted on 31 January 1921,³⁸ although considerable alterations to the fittings needed to be done: a figure of £500 was mentioned.

The major problem now, however, was that of a Curator. The Director wrote to J. C. Murray on 31 January 1921,³⁹ regretting Fagan's death the previous day, mentioning the difficulty over accommodation, but mainly concerned with the lack of money for 'an assistant'. Could Murray help, as his father had indicated was his intention? If the Treasury allocated the money, Trustees would consider employing James Chumley; otherwise, could he be lent to the Museum to pack up and unpack the collection? Murray replied on 7 March:⁴⁰ his family was unable to provide a permanent Curator but would pay Chumley's expenses for a few months. He offered to visit the Museum to discuss the matter with the Director. Accordingly, Harmer wrote on 16 March⁴¹ to Professor Graham Kerr, in whose Department (Zoology in the University of Glasgow) Chumley was now a Research Fellow. Could he be spared for a few months – the Murray family were prepared to pay his expenses – and, if Treasury sanction was obtained, what would be the chances of his taking up permanent employment, and what did Kerr think of him? Professor Kerr replied on 9 April,⁴² speaking of Chumley in the highest terms. He was ideally suited to be the permanent Curator of the Murray Collection and had all the necessary knowledge to conduct and direct research on the material. But he was 59, now a Research Fellow, doing various jobs in the Department, including giving a summer course of lectures on Oceanography, and drawing total emoluments of £400 p.a. Nor did he want the temporary job of moving the collection. Harmer wrote back to Kerr on 18 April.⁴³ Chumley was really too old; ten years' service was the minimum required for a pension and the Museum should try for a younger man. But would Chumley work for a few months, paid by the family, to supervise the move? Kerr handed this letter to Chumley, asking him to reply to it. This he did, on 20 April,⁴⁴ in no uncertain terms. Enclosing a copy of a long letter on the same subject he had written on 21 March to J. C. Murray, he outlined his terms and conditions for salary and pension. He cited his 12 years of Government service in the Challenger Office, and a

colleague who had had his similar service treated as reckonable for pension purposes. He felt that all the arrangements regarding the transfer of the Murray Collections should have been discussed the previous year and ventured to suggest that the removal be deferred until, say, 1 April 1922, 'that in the meantime the Museum may decide upon the policy to be adopted, may approach the Treasury with a definite scheme, and the approval of the Treasury secured before 1st January 1922, enabling [him] to give the University Court three months' notice of [his] resignation'. Any temporary arrangement was out of the question as being hardly fair either to the University or to himself. Perhaps predictably, Harmer wrote to Charles Tate Regan, Keeper of Zoology, who was to succeed Harmer as Director, on 21 April:⁴⁵ in effect, he was not impressed. Regan replied on 25 April⁴⁶ that it seemed as if the Museum must do without Chumley. Harmer wrote to Murray on 28 April,⁴⁷ thanking him for his letter saying that Chumley did not want to be employed in a temporary capacity, and saying how awkward Chumley was being and should the whole idea of employing him be abandoned. Murray replied on 1 May saying that he could not understand Chumley's behaviour, and agreeing that any question of employing him should be abandoned. Harmer wrote on 3 May to Kerr, thanking him for his help and saying that the matter was being dropped, and in similar terms on the same day to Chumley. There was, for the time being, to be no Curator of the collections.

On 18 July 1921⁴⁸ Tate Regan wrote to Trustees about the fitting out of Block B and a proposed date for the removal. He followed this with a letter dated 26 July⁴⁹ to J. C. Murray, asking when the removal could be arranged. Murray wrote to Dr W. T. Calman, Deputy Keeper of Zoology, on 29 July⁵⁰ to initiate the arrangements for the move. Messrs Sloan and Son, Ltd., of Edinburgh, were to carry out the work; the move would be by van, rail and sea. Dr Calman would oversee the initial stages but the bulk of the supervision of the packing would be in the hands of Mr G. A. Smith, Clerk, of the Department of Zoology, who replaced the previously suggested Mr W. E. Barnett.

On 13 October 1921⁵¹ Dr Tate Regan was able to report to Trustees that the John Murray Collection had arrived safely in the Department of Zoology. The following day,⁵² the Director, Sir Sidney Harmer, wrote to inform J. C. Murray of this fact. On 18 October⁵³ Regan wrote to Calman about the rocks in the Collection and asked also in whose name the Collection had been presented. The last official letter concerning the presentation was that of the Director, on behalf of Trustees, of 15 November,⁵⁴ to J. C. Murray. The historical instruments reached the Science Museum as arranged, except that the balance and some microscopes were transferred to the room of Dr G. T. Prior, Keeper of Mineralogy; they are still in the Department.⁵⁵⁻⁶⁰ Murray's solicitors,⁶¹ supported by the Museum, succeeded in convincing the Inland Revenue that – apart from the library – the Collection was of 'no commercial value' and therefore was not liable for estate duty. But the question of a Curator was to be raised once more before the post-war economic situation was allowed to inhibit any further action for more than a dozen years. Robert Dykes, who had been Chumley's assistant, applied for the curatorial post. The Director wrote⁶² to Professor Stanley Gardiner in Cambridge for a reference, but Gardiner did not remember Dykes.⁶³ He took the opportunity, however, to inveigh against a mob of 1500 undergraduates who had recently attacked the great bronze gates of Newnham College with a cart, to the tune of £600 worth of damage. Harmer then asked Dr F. A. Bather,⁶⁴ who spoke well of Dykes.⁶⁵ But there was as yet no money and on 26 October Harmer replied to Dykes regretting that the Museum was unable to offer him a job.⁶⁶ There was still no Curator, but at least – and at last – the Sir John Murray Collection was safely housed in Block B, in the care of the Department of Zoology (Plate 7).

The John Murray Expedition

On 19 May 1932⁶⁷ Professor J. Stanley Gardiner, of the Zoological Laboratory, University of Cambridge, wrote to the Chairman of Trustees of the Museum. He stated that Sir John Murray had left the income from 250 shares in the Christmas Island Phosphate Company – on the Indian Ocean guano island, not the better known Pacific Ocean island – to be spent on



Plate 7 Part of the *Challenger* collection of deep-sea sediments, manganese nodules and rocks, in the Department of Mineralogy.

'scientific research or investigations or explorations which are likely to lead to an increase in natural knowledge and especially in the science of oceanography and limnology'. About £20000 had accumulated (Burstyn, 1975) and it had been decided to send an expedition to the western Indian Ocean under the leadership of Lieut.-Col. R. B. Seymour Sewell, with Dr E. F. Thompson as deputy (Rice, 1986). The choice of this ocean was apt, since only the southern part had been visited by the *Challenger* and Murray himself had noted the omission. The collections taken were to be offered to the Museum to be added to the Murray Collection, 'but not to be kept in any way apart from the general collections of the Museum'. Dr C. T. Regan, then Director of the Museum, replied to Gardiner on 3 June:⁶⁸ Trustees would be pleased to accept the collections and had appointed himself (Regan) as Museum representative on the committee being formed to organize the John Murray Expedition, of which J. C. Murray was appointed Chairman on 20 June 1932. The Hydrographer of the Navy, Vice-Admiral Sir John (A.) Edgell was also a member. The cruise would last nine months and Trustees of the Museum would contribute up to £200 for storage bottles, etc.⁶⁹⁻⁷⁰

After various ships had been considered, including the RRS *Discovery*, the *William Scoresby*, the Danish research ship, *Dana*, and the *George Bligh*, the expedition took place from 1933 to 1934 in His Egyptian Majesty's Ship *Mabahiss*, under the command of Captain K. N. MacKenzie, which King Fuad and his government had loaned to the organizers (Plate 8).



Plate 8 HEMS *Mabahiss*.

On 22 October 1934⁷¹ Murray wrote to the Director reminding him that a duplicate set of specimens had been promised to the Egyptian Government in return for the loan of the *Mabahiss*. On the same day, Murray also wrote to the Director asking whether Trustees would undertake the publication of the scientific results of the expedition; the Director replied on 13 November⁷² in the affirmative, and the results are contained in 11 volumes of scientific reports, published between 1935 and 1967 and arranged according to the three main lines of research undertaken: the physical and chemical characteristics of sea-water at all depths; the general topography and nature of the sea-bottom; and the collection of deep-sea fauna, especially from the depth zone between 100 and 2000 metres. As agreed, the collections were to come to the Museum and a year later there was to be some correspondence concerning the specially fitted cabinet required to house the cores taken on the expedition.

After some diplomatic correspondence in 1939,⁷³⁻⁷⁵ it was agreed that the duplicate specimens would be sent to the Fuad 1st Institute of Hydrobiology and Fisheries, Alexandria, and not to the rival University of Cairo. The war, of course, intervened and it was not until the winter of 1949-50 that, after further correspondence⁷⁶ about to whom to send them and who should pay the freight, they finally arrived in Alexandria.

The Oceanographical Room

On 27 July 1934⁷⁷ J. C. Murray wrote to Professor Gardiner to ask what was being done about a Curator for his father's Collection; the then Director, Sir Sidney Harmer, had promised a quick appointment and the family felt 'badly let down'. Gardiner⁷⁸ passed the message on to the new Director, Dr Charles Tate Regan, who responded quickly. The post-war depression, which had prevented an earlier appointment, had eased and he was able to write on 13 August⁷⁹ to the Lords Commissioners of the Treasury: 'we promised to appoint an Assistant Keeper and now request funds to enable us to do so'. According to a letter from J. C. Murray to Seymour Sewell, such an appointment would hasten the transfer of the *Mabahiss* collections from Cambridge to the Museum. A month later, on 18 September,⁸⁰ the Secretary of the

Treasury authorized the appointment of the new Assistant Keeper to curate the Oceanographical Collection and the post was advertised in *The Times* and *Nature* on 4 and 6 October 1934, respectively. Originally intended as a Department of Zoology appointment, Trustees now felt it more appropriate to the Department of Mineralogy and proposed to transfer the collection accordingly.

The collection was housed in Block B and from 1927 onwards, following the initiation of the Discovery Committee (Deacon, 1984, and p. 88), on which the Museum was represented, it shared the building with the Whale Research Unit of the Discovery Investigations until it was moved for safety in 1940 to the centre of the Museum's basement. Accordingly, Block B became known as the 'Discovery Hut' or 'Discovery Building' (Plate 9). A galvanized iron and wood temporary building, acquired from the Office of Works in 1921, it strongly resembles in many ways the Discovery House, another specially designed prefabricated building erected in Grytviken, South Georgia (Plate 16) in January–February 1925. Both buildings still stand; Block B is situated at the northwest rear of the Museum and measures some 38×18 m. These dimensions suggest a rather larger area (over 653 m^2) than the 437 m^2 stated by the Office of Works. The black and white painted hut has transverse gabling, indicating its sections. This distinguishes it from the longitudinally gabled but otherwise similar buildings which lie in line westwards (Block D) and across the roadway to the northwest (Block A). These are of interest; now belonging to the Royal College of Art, they are rumoured to be very similar in design to the experimental prefabricated modular field hospital buildings designed by I. K. Brunel for Florence Nightingale that were set up at Scutari in Turkey in 1855, only to be sold off *in situ* the following year when the Crimean War ended.

No immediate appointment followed the 1934 advertisement, but Professor Gardiner wrote⁸¹ from Cambridge to the Director on 11 March 1935 to say that Dr John Dugdale Holt Wiseman (1907–) would be examining the clay minerals in the *Mabahiss* material in the Department of Mineralogy and Petrology there: 'sub-aqueous questions of very great importance . . . work that is entirely new and a distinct advance'. Wiseman was a petrologist who gained his Cambridge doctorate with a thesis on the epidiorites of the central and southwest Highlands of Scotland. He subsequently applied for the post and was appointed Assistant Keeper on 1 October 1936.

In November 1935 the Murray Collection was transferred from the Department of Zoology to the Department of Mineralogy: this was reported to Trustees by the Keeper of Mineralogy, Dr G. F. Herbert Smith, on 18 November.⁸² Some of it went later to the Department of Palaeontology, whilst the island rocks and phosphates had previously been detached from the main collection and presented to the Department of Mineralogy in November 1921. The collection was housed in war surplus cupboards, which were dusty and dirty and needed dustproofing. The concern of the Murray family was perhaps justified; although labelled, the collection was somewhat ill-housed. Accordingly, a newly appointed Assistant Keeper, Dr G. F. Claringbull, who joined the Museum on 1 October 1935 and was later to become Keeper of Mineralogy and, as Sir Frank Claringbull, Director of the Museum, was delegated on 18 November to 'work through, put in order and clean up, but not to work on, the *Challenger* collection'. He should do no research on the collection, in case the new Assistant Keeper should 'be possessed of peculiar qualifications for that work'.⁸³ The Director, Dr Regan, wrote on 28 November to Dr Bernard Smith, FRS, Director of the Geological Survey of Great Britain next door in Exhibition Road, suggesting that they should present the British Museum with their collection of deep-sea deposits from the Bahamas. If he agreed – which he did not – the Keeper of Mineralogy would be in touch with him.

Late in June 1936, at Col. Sewell's suggestion, Dr F. A. Bannister, Cambridge physicist and by now crystallographer in the Department of Mineralogy in the British Museum (Natural History), treated the *Mabahiss* cores with vinyl acetate in Cambridge as a preservative measure.⁸⁴ On 1 October J. D. H. Wiseman took up his appointment⁸⁵ and on 10 April 1937⁸⁶ Dr Herbert Smith wrote to the Director concerning the setting up of an 'Oceanographical Room', in an area formerly used by Heron-Allen and adjoining the chemical laboratory. He followed this on 17 April⁸⁷ with a memorandum to Trustees, reporting that Wiseman had



Plate 9 The Discovery Hut or Block B, showing the three main units of the building. In the left background is the west-central tower of the main Waterhouse Museum building. In the centre middle ground is the Department of Zoology Spirit Building, built between 1920 and 1930, and in the left centre the west end of the art deco Whale Hall, constructed between 1930 and 1934. The Entomology Block, begun in 1934 but, because of the war, not completed until 1952, is visible behind the Spirit Building.

returned to the Museum on 1 April from Cambridge, where he had spent the first six months of his Museum appointment, at Professor Gardiner's suggestion, working on the *Mabahiss* clays and, latterly, on the basaltic rocks dredged from the Carlsberg Ridge. The massive centrifuge, which had belonged to the Trustees of the Murray Collection, was presented by them to the Museum. It was transported to the Museum and set up in the store-room near to the Oceanographical Room. The starting gear had been damaged in transit between Manchester and Cambridge, so that there could be no trial. The instrument had been designed at the National Physical Laboratory as a new experimental type, to perform a wide variety of functions: in the event, it did none. Severe vibration resulting from the belt drive through high and low speed motors to the vertical spindle pulled the latter out of true. As a result, the centrifuge was never used and it was replaced in the 1960s by more modern instruments. It was finally dismantled in 1980 and presented to the Science Museum. At the end of November 1937, Wiseman⁸⁸⁻⁸⁹ collected the cabinet of exceptionally interesting *Mabahiss* cores from Cambridge and the Oceanography Section within the Department of Mineralogy could be said to have become operational.

Wiseman's interests were wide-ranging. Primarily a petrologist, he became interested in

oceanic basalts as a response to Professor C. E. Tilley's view that there was no need to look under the sea: the evolution of crystalline rocks need only be studied on land, where all the necessary evidence could be found. Certainly, the Geological Society was largely content to limit its fields of interest to the British Isles. His interests in oceanography extended far beyond igneous rocks, however, as suggested by his work on clays. Chemical analyses for carbon, nitrogen and the rock-forming oxides carried out at Imperial College, London, on the *Mabahiss* cores by Miss Hilda Bennett, funded by the Murray Trust, led Wiseman to deduce that Fe and Ti are deposited in sediments at a constant ratio (Wiseman & Bennett, 1940). This was followed by research on foraminifera and on problems of physical oceanography and submarine geomorphology.

Wiseman was awarded a John Murray Oceanographical Research Scholarship in 1935. The fund derived from the Murray Trust, whose trustees were persuaded in 1952 by Professor Hans Pettersson, at Cambridge, to pass its administration to the Royal Society, whose first award was to W. R. Riedel. Wiseman used his tenure as a Murray Scholar to examine rocks dredged from a depth of 340 m from the side of Providence Reef, a coral islet some 354 km NNE of Madagascar in the Indian Ocean. The rocks were dredged – a very inexpensive method of acquiring samples – by Sir Clive Forster-Cooper, Cambridge zoologist and later Director of the British Museum (Natural History), during the Percy Sladen Trust Expedition in HMS *Sealark* in 1905. Its leader, Professor J. Stanley Gardiner, sent samples to Sir John Flett, then Petrographer and later Director of the Geological Survey, for examination. Unfortunately, they were never looked at but Gardiner kept duplicates at Cambridge. These were sent to Wiseman; when he subsequently returned them to Cambridge they were mislaid by Albert Brighton, Curator of the Sedgwick Museum, who at the time was unwell. However, a thin-section survives and is in the British Museum collection. Wiseman (1936) found the rock to be a basaltic agglomerate, containing also Eocene-Oligocene foraminifera in a matrix of calcite. Analysis of the basalt fragments showed it to be limburgitic in nature. His work demonstrated that the Providence Reef had a volcanic formation of Tertiary age, the first time ocean-floor basement rocks older than Recent had been described, and therefore of great significance in the light of the Funafuti boring (see page 79).

In 1938, with the support of Vice-Admiral Sir John Edgell, Hydrographer of the Navy, Wiseman put up a proposal for the study of a small area of the Mid-Atlantic Ridge, analogous to the work of the John Murray Expedition on the Carlsberg Ridge, in the Indian Ocean. The Hydrographer was prepared to provide a ship and the project was to be in collaboration with the Department of Geodesy and Geophysics, University of Cambridge. Small bombs would be exploded at depth and used to measure times of travel of sound waves to buoys carrying hydrophones, anchored on taut wires. The arrival of the sound-waves would transmit signals to the ship, providing accurate depth contours. Dr W. Campbell Smith, Keeper of Mineralogy, also supported the idea and suggested the involvement of the Geological Society of London: it would thus be a joint British Museum (Natural History)–Cambridge–Geological Society expedition. Unfortunately, the signals of the approaching war put paid to the idea.

In the same year – 1938 – Wiseman attended the International Union of Geography meeting in Amsterdam – a conference dominated by Germany – where he was appointed by the Royal Geographical Society as International Rapporteur to the Oceanography Section. The following year he travelled to the USA, paying visits to Chicago, Harvard, the Woods Hole and Scripps Institutions of Oceanography and to Washington, where he presented a paper to the International Union of Geodesy and Geophysics.

The National Institute of Oceanography

Between the two World Wars, the British oceanographical effort centred on the Antarctic, conducted by the Discovery Committee around the area of the Falkland Islands Dependencies and mainly devoted to whale research. The current Keeper of Zoology at the Museum sat on the Royal Society British National Committee for Oceanic Research. Towards the end of the 1939–45 war, the Scientific Advisory Committee of the War Cabinet recommended to the Sub-

Committee for Oceanography of the British National Committee for Geodesy and Geophysics that a National Institute of Oceanography be established in Britain after the war, and an oceanographic expedition mounted. J. D. H. Wiseman, who had served on the Sub-Committee before the war, was seconded during the war to the Admiralty where he served in Queen Anne's Mansions as an Assistant Principal in CW (Commission and Warrant) II. On 16 February 1944⁹⁰ Admiral Edgell, the Hydrographer, wrote to him informing him of a meeting of the Sub-Committee to be held on 1 March to discuss the proposed post-war plans. Edgell had for some time regarded the Discovery Investigations Committee as being 'too biological' in its outlook, paying far too little attention to the sea-floor. Sent in fact to another 'Wiseman', the letter arrived after the event.⁹¹ At the meeting, it was decided to recommend to the National Committee that a National Oceanographic Institute should be set up: the Sub-Committee's three pages of proposals were summarized by Dr G. E. R. Deacon.⁹² Wiseman agreed to attend the next meeting, arranged for 26 May 1944, and survived the explosion of a flying bomb some 60 m from his work-place to do so.⁹³ As a result of the meeting, the Royal Society⁹⁴ charged a small sub-committee consisting of Professor J. Proudman, Professor G. R. Goldsbrough and Dr J. N. Carruthers with the task of making proposals for the establishment of the Institute of Physical Oceanography. Proposals were put forward by Lieut.-Com. J. R. Lumby, RN,⁹⁵ on which Wiseman commented in a letter to Carruthers dated 21 June 1944,⁹³ and on 5 July⁹⁶ a précis was compiled giving the opinions held by various concerned people on Lumby's proposals.

Throughout that summer, memoranda were circulated by Carruthers and Admiral Edgell inviting comments and suggestions on the proposals and draft final report, including Wiseman's hope that 'adequate attention [would be paid] to marine biology and marine geology'.⁹⁷ He also commented on the large size of the governing body and suggested that a Council be set up. Wiseman was listed as a member of the Sub-Committee whilst still working at CW II and later, after the war, was duly notified on 24 November 1947⁹⁸ of a meeting to be held in the Royal Society on 3 December to consider the list of co-opted members, which differed slightly from the 1944 list. The Minutes⁹⁹ of this meeting ratified final membership of the Sub-Committee.

Pending the grant of a Royal Charter for a National Oceanographic Council, the Sub-Committee led to the formation on 1 April 1949, under a provisional Executive Committee appointed by the Admiralty, of the new National Institute of Oceanography; the Committee was chaired by Sir Frederick Brundrett. Dr G. E. R. Deacon was appointed Director and Captain (S) R. H. G. Franklin, RN, Secretary. The Royal Charter was sealed on 15 December 1950 and a larger Council under the Chairmanship of the Civil Lord of the Admiralty, W. J. Edwards, replaced the provisional Executive Committee. Dr N. A. Mackintosh was now appointed Deputy Director. Wiseman joined the Council in 1956–57, on the recommendation of the President of the Geological Society, Professor Leonard Hawkes, FRS, and served until 1962–63.

Until suitable premises could be acquired, the units of the NIO were housed in the London area – with Dr Mackintosh's Whale Research Unit and the Discovery Collections in the care of Dr H. E. Bargmann at the British Museum (Natural History) – and also at Plymouth and in Cornwall. The Whale Research Unit was transferred in March 1977 to the Sea Mammals Research Unit, British Antarctic Survey, Cambridge, after 50 years at South Kensington. Although Wiseman would have liked the NIO to have been established on the land at the rear of the Museum, negotiations were instituted to lease from the Admiralty buildings erected in 1943 as an extension of the Signal and Radar Research Establishment at Haslemere. These premises were in Brook Road, Wormley, near Godalming, in Surrey. Although some 50 km from the sea this choice was governed chiefly by factors such as size, suitability and availability. Staff and equipment were moved in between late 1952 and February 1953, in which latter year Dr J. N. Carruthers was seconded from the Admiralty and appointed Assistant Director. Thus the National Institute of Oceanography came into being, under the initial directorship, until 1971, of Sir George Deacon, and later – in 1973 – to change its name to the Institute of Oceanographic Sciences, one of the research institutes of the recently

formed Natural Environment Research Council. A fitting tail-piece tells how, during the reception to open the *Challenger* Exhibition at the British Museum (Natural History) on 27 February 1973, a conversation took place around the photographs of HMS *Challenger's* figurehead, which were included in the exhibition. The figurehead stood at that time in the front garden of the office of the Commander-in-Chief, Fleet, at Northwood, north London. Then and there it was agreed to present it to IOS where, newly refurbished in resplendent colours, it was ceremonially unveiled on 22 June of the same year (Plates 10–11).

Post-war Developments

J. D. H. Wiseman returned to the Museum on 20 May 1946, having been promoted in his absence as well as being appointed to the Sub-Committee to promote the establishment of the National Institute of Oceanography. Immediately before the war, his research interests had lain in several directions. Firstly, he worked on the clays and igneous rocks cored and dredged by the *Mabahiss* on the John Murray Expedition of 1933–34. Secondly, he became interested in foraminifera and other planktonic protozoa, as well as in physical oceanography. His last job with the Admiralty, before being released, was to visit the British Zone of Germany on an intelligence mission to ascertain the state of their oceanographic institutions (Wiseman, 1946). Wiseman visited three major and three minor establishments: the former were in Göttingen, under Professor C. W. Correns; Hamburg, under Professor O. Pratje; and Kiel, under Professor G. Wüst – the Berlin Meereskunde had been destroyed. Before the war, research work arising from the cruises of the *Meteor*, among others, had helped the Germans to lead the field and, as well as gaining information, charts and literature, Wiseman was there to help them re-establish their scientific effort. In 1948 he visited Oslo to re-establish contacts with American oceanographers and others at a meeting of the International Union of Geodesy and Geophysics.

Wiseman supervised the expansion of the Museum's Oceanography Section and the transfer of the collection in 1951 from its cramped wartime quarters in the basement into cupboards acquired as war surplus from the War Office. These had been stored in St James's Park and were placed in the 'War Room', a concrete sub-surface labyrinth constructed in the Museum's east gardens as a wartime headquarters of the Civil Defence (Plate 12). He continued his work on foraminifera with Dr C. D. Ovey and others; among the latter was Dr W. R. Riedel, specialist in siliceous microplankton. His recruitment by the Museum was suggested, but came to nothing; much later, in 1968, he became the Curator of the Deep Sea Drilling Project at Scripps Institution of Oceanography, La Jolla, California. Mr H. A. Buckley, who joined the Section in 1961, became interested in foraminiferal research and succeeded Ovey and Riedel as Wiseman's collaborator. Wiseman's collaborative work extended to material collected by the Swedish Deep-Sea Expedition of 1947–48 in the *Albatross*, on which he worked with Ovey, Professor Hans Pettersson (the leader), Dr Gustav Arrhenius, Dr B. Kullenberg, Dr R. W. Kolbe and others.

In 1952 the Director, Sir Gavin (R.) de Beer, asked Wiseman to assist the Swiss hydrobiologist, Professor Otto Jaag, who was studying pollution in Lake Zurich. Wiseman used the new Kullenberg-type piston corer to obtain sediment samples through the central hole ('moon-pool') in a barge. The results, based on the frequency of the black anoxic layers containing the diatoms and algae which caused the pollution, indicated that the fouling occurred only during the summer months, since approximately 1900.

Wiseman attended meetings of the International Union of Geodesy, the Marine Biological Association at Plymouth, of which he was a Council member, and many other conferences. As well as the National Oceanographic and MBA councils, he served once more on the Physical Oceanography Sub-Committee of the BNC for Geodesy and Geophysics, the INQUA Commission and Sub-commissions for Deep-Sea Sediments, the Lithology and Genesis of Quaternary Deposits, and their Absolute Age. He also sat on the Geological Society Marine Studies Group Committee, the NERC Committee on Ocean Floor Sampling, and – in 1971 – the Royal Society of Edinburgh Sub-Committee for the *Challenger* Celebrations of 1972. He



Plate 10 HMS *Challenger*'s figurehead at Northwood, in the garden of the office of the Commander-in-Chief, Fleet.

collaborated in the planning of the Museum's *Challenger* Exhibition, at which Murray's unmarried daughter was present. He was on the editorial board of *Deep-Sea Research* from its inception in 1953 until 1973 and, with Ovey, published papers in Volumes 1, 2 and 3.

During his time at the Admiralty, Wiseman had developed a strong link with the Hydrographer of the Navy and his department. As a result, an arrangement was set up whereby every tenth sounding sample taken by Royal Naval Survey ships was sent to the Museum. This coverage – at first world-wide – greatly enhanced the collection and it still does, although of recent years economic constraints have led to a restriction on the activities of the ships, with a greater emphasis on home waters. Deep-draught oil tankers have also necessitated the re-surveying of the English Channel and its approach waters to a very great degree of accuracy. Under a succession of Hydrographers – Rear-Admirals E. G. Irving, G. S. Ritchie, G. P. D. Hall, D. W. Haslam and R. O. Morris – a very substantial collection of



Plate 11 HMS *Challenger*'s figurehead, now at the Institute of Oceanographic Sciences, Wormley, Godalming, Surrey.

sounding samples, taken by Shipek grab, underway sampler and various other methods has been built up. Links with oceanographic institutions throughout the world, especially in the USA, led to further expansion of the collection.

Wiseman was promoted to Principal Scientific Officer on 1 May 1950 and in October and November 1956 was granted special leave to participate in Survey ship cruises. The highlight of



Plate 12 The 'War Room' in 1966, just after a severe flood had damaged some of the labels on the glass jars; the contents were unharmed.

this phase was a cruise in HMS *Owen* in 1960–61 (Plate 13), with Commander Hall, later Hydrographer, which yielded a valuable collection of cores and included the fourth recorded landing – after those of Charles Darwin in the *Beagle*, the *Challenger* scientists and Dr G. Vibert Douglas in the *Quest* – on St Peter and Paul Rocks, South Atlantic Ocean. Wiseman's other interests included manganese nodules, cosmic spherules and aeolian dusts; he became Deputy Keeper of Mineralogy on 1 December 1968 and retired in September 1972 (Plate 14).

Dr D. R. C. Kempe joined the Section in 1970, when the collection and research laboratories moved to an out-station at North Acton. This became necessary when the New East Wing, to house the Department of Palaeontology, was built on to the Museum. Unsuccessful attempts were made to demolish the 'War Room', in the middle of the site, by explosives, and it was integrated into the new wing as a sub-basement. The first British Museum (Natural History)-NERC Joint Institute Research Student, A. J. Fleet, came to the Section in 1972, working jointly with Dr P. Henderson, then at Chelsea College, University of London, on sediments collected by Kempe on Leg 26 of the Deep Sea Drilling Project. During the Acton period, Westward TV filmed some of the *Challenger* manganese nodules on 18 October 1977 for the film *The Selling of the Sea*; shortly afterwards, in early 1980, the building at Acton was vacated and the collection moved to a new, larger out-station at South Ruislip.

In the late 1970s, it was decided to change the name of the Section to Oceanic Petrology, to encompass the Ocean Bottom Deposits Collection. A second NERC research student joined the group in collaboration with Imperial College, University of London, and Dr Kempe served as Chairman of the Geological Society Marine Studies Group and of the UK IPOD Ocean Crust Panel.

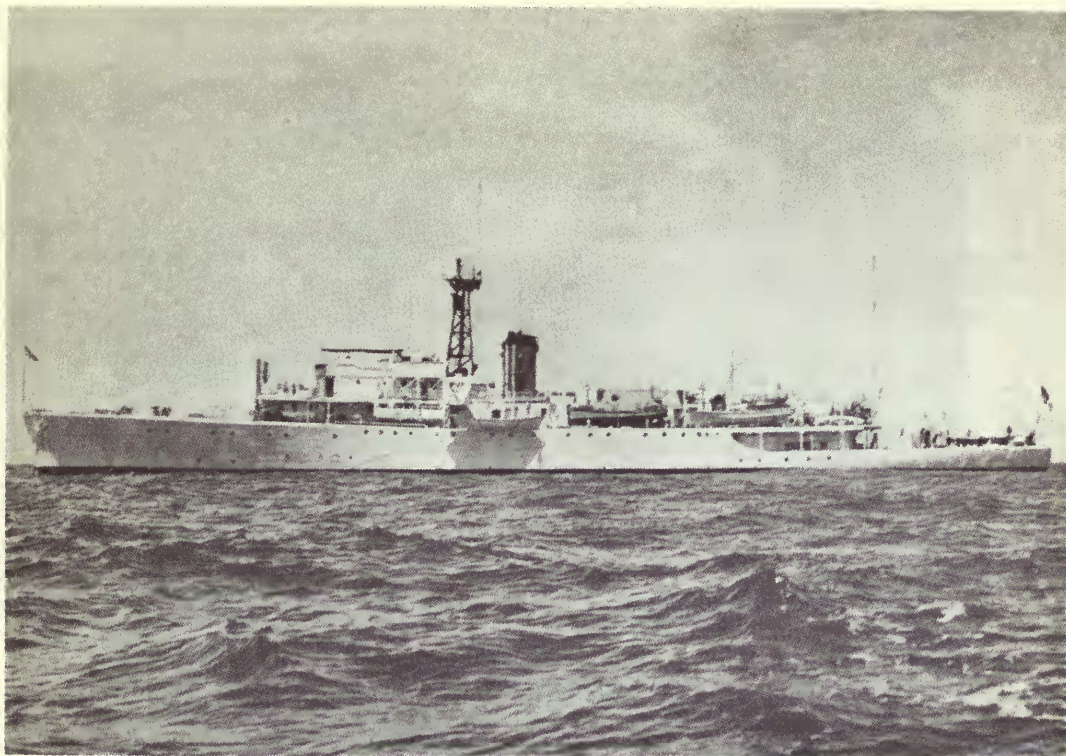


Plate 13 HMS *Owen*.

The Ocean Bottom Deposits Collection

The size of the collection has been recently assessed at approximately 25000 specimens. It was based on the John Murray collection of 9746 sounding samples, used as the basis for Murray's deep-sea deposits map of the world. There are also the manganese nodules, dredged for the first time from the deep ocean and thought, before analysis, to be lumps of pitch. The rock samples, collected mainly from oceanic islands, including St Peter and Paul Rocks, also contain basalt from the Mid-Atlantic Ridge (MAR) and pumice and other fragments of acid rocks dredged from the Pacific Ocean. The *Challenger* soundings from the MAR virtually delineated the ridge, although at the time it was recorded merely as a submarine mountain. Some large dredged boulders are included in the collection. Amongst these are a piece of basalt from the Discovery Tablemount weighing more than 5 kg (Buckley, 1976; Kempe, 1973; Kempe & Schilling, 1974); a boulder of porphyritic olivine basalt from near the Balleny Islands weighing 37 kg; and two boulders of greywacke from the Bay of Whales registering 40 and 21 kg (Kempe, 1973).

Possibly the first deep-sea sediment samples to be collected and retained are represented in the collection; taken in 1844 by the US Coast Survey Brig *Washington*, they came from the east coast of the USA. The first Mid-Atlantic Ridge basalt to be described is represented by a thin-section only: the rock had disappeared, possibly in Cambridge or in Switzerland, and so was never presented to the Museum. It was accidentally 'grappled' by the cable ship *Faraday* in 1874, and described in the first paper in the newly-launched *Mineralogical Magazine* (Hall, 1876). Between 1896 and 1898 the Royal Society mounted a series of drilling expeditions to Funafuti, an atoll in Tuvalu (formerly the Ellice Islands), in the western Pacific Ocean. Their aim was to test Darwin's hypothesis that coral islands grew upwards on subsiding volcanic



Plate 14 Dr John D. H. Wiseman in 1969.

islands or seamounts. Sir John Murray, incidentally, thought that coral atolls developed outwards on rising shoals or shallow banks of volcanic origin, thus keeping below the water surface. He never voiced this opinion openly, however, in view of the eminence of the other current protagonist in the argument. Although basalt was never reached, cores totalling 340 m in depth were obtained and subsequently sliced longitudinally. One half is in the Museum's collection, the other half in the Australian Museum in Sydney. The point was finally resolved in 1950 when a boring at Eniwetok, another Pacific atoll used to test the first hydrogen bomb,

reached basalt at a depth of 1353 m: a sample of this rock is in the collection. The Niue Island core from the south Pacific, described by Rodgers *et al.* (1982), is also represented in the collection. Of interest, too, are the drums of sea-water from the Southern Ocean, collected by the British Antarctic Survey after the atom bomb explosions but before the hydrogen bomb.

Early collections were registered under 'Expeditions'. To rationalize this and to make the location of specimens infinitely easier and quicker, a Marsden square grid system was devised whereby samples are arranged by 10° latitude bands, away from the Equator, and then by 10° squares, from west to east. The collection is curated by H. A. Buckley and contains some 25000 oceanic rocks, cores and rod samples – notably the *Mabahiss* and *Owen* cores – and the Royal Navy and other sediments; all are recorded in the two-part catalogue of Buckley *et al.* (1979 and 1984).

Rock and Mineral Research

John Wiseman's work on the igneous rocks dredged during the John Murray Expedition from the Carlsberg Ridge, north-western Indian Ocean, resulted in his characterization of ocean-floor basalt some 30 years before the serious study of ocean-floor rocks began and the basalt was recognized as a ubiquitous oceanic rock type, hardly resembling the Deccan Trap basalts as had been expected. He wrote two papers on ocean tholeiite, or MORB (mid-ocean ridge basalt) as it is now known, with its low K₂O and high H₂O content and Fe₂O₃/FeO ratio (Wiseman, 1937; Wiseman & Sewell, 1937). In the latter, using topographical data, Wiseman and Sewell were able also to demonstrate the close resemblance between the ridges of the Arabian Sea and the East African rift system: a fundamental conceptual connection that much later came to be appreciated. Wiseman also collaborated in a paper on the chemistry of sediments from the Arabian Sea (Wiseman & Bennett, 1940).

Wiseman's second major interest had now become a study of the temperature-related fluctuations in the tests of planktonic foraminifera and, later, coccoliths. He demonstrated that the Pleistocene climatic variations in the North Atlantic could be determined from variations in the oxygen isotopic composition of certain foraminiferal shells. This work was coupled with a general interest in physical oceanography, resulting in a series of papers, many in collaboration with Dr C. D. Ovey, a zoologist in the Museum, both before and after the war, and later with H. A. Buckley. Papers in these areas in fact account for the bulk of Wiseman's 30 or so more important contributions, including those written when he was Chairman of the International Committee on the Nomenclature of Ocean Bottom Features, charged with the study of the rules of their definition (Wiseman & Ovey, 1950; Wiseman, 1953; Wiseman & Hendeby, 1953; Wiseman & Ovey, 1953; Wiseman, 1954; Wiseman & Ovey, 1954; Wiseman & Ovey, 1955*a* and *b*; Herdman *et al.*, 1956; Wiseman & Hall, 1956; Wiseman, 1959; Wiseman, 1964; Wiseman, 1965*a*, *b* and *c*; Wiseman, 1966*a*; Shackleton *et al.*, 1973).

Another field in which Wiseman made a substantial contribution to oceanography resulted from his visit in HMS *Owen* to St Peter and Paul Rocks. Close examination of these fragments of mylonitized ultramafic mantle rocks, raised tectonically to the surface of the ocean, revealed the presence of two or even three distinct secondary amphibole phases, resulting in several different rock types (Wiseman, 1966*b*). He maintained his work on foraminifera and climatic variations, however, working still with H. A. Buckley and Dr N. J. Shackleton, at Cambridge. Unfortunately, circumstances prevented him from accepting an invitation in 1968 from JOIDES to act as co-chief scientist, with Dr W. Maurice Ewing, on Leg 1 of the newly instituted Deep Sea Drilling Project.

Between 1966 and 1968 Dr J. R. Cann worked in the Section on oceanic eruptive igneous rocks (Cann, 1968). Kempe, and also Dr L. R. Johnson, who joined the group in 1971, participated in research cruises; Kempe crossed the Atlantic in the Canadian research ship *Hudson* in 1971, becoming involved in drilling the Mid-Atlantic Ridge basalts using the Brooke-Bedford Institute deep-sea ambient pressure drill. The following year he participated in Leg 26 of the Deep Sea Drilling Project as petrologist and sedimentologist, crossing the Indian Ocean in the DV *Glomar Challenger* from Durban to Fremantle (Plate 15). In the same



Plate 15 DV *Glomar Challenger*.

year, 1972, Johnson took part in the Mediterranean Sea cruise of RRS *Shackleton*, collecting several cores from near Cyprus. Several research projects resulted from these activities. Kempe described the basalts from several sites drilled in the Indian Ocean and noted and described a very rare occurrence of metasomatic hydrogarnets in the baked nannoplankton ooze overlying the basalt (Kempe & Easton, 1974; Easton *et al.*, 1977). Dr A. J. Fleet successfully completed his thesis on the sediments from DSDP Leg 26 and published some of his results in Fleet & Kempe (1974), Fleet *et al.* (1976) and Fleet & McKelvey (1978). Kempe went on to contribute papers on the petrology and mineralogy of basalts from Legs 34 and 37 of the DSDP (Kempe, 1975), as did Dr A. L. Graham on Leg 45.

The Discovery Tablemount (or Discovery Bank) was first located in May 1936 during the *Discovery* investigations. A large boulder of basalt was dredged, probably at the suggestion of J. W. S. Marr, and both tablemount and basalt were first described in detail some 40 years later. Buckley (1976) gave a detailed account of the morphology of this small tablemount chain, while Kempe & Schilling (1974) discussed the petrology and mineralogy of the basalt, showing its possible origin as a manifestation of a mantle hot spot. Johnson collaborated with Buckley on an account of the Cyprus cores and their significance (Buckley *et al.*, 1982) and published a number of papers on aeolian dusts and oceanic clay mineralogy (Johnson, 1979; Buckley *et al.*, 1974). Rodgers *et al.* (1982) described the chemistry and dolomitization of the Niue core and some work has been carried out on the Funafuti material.

There has been comparatively little research on minerals. Nevertheless, Bannister & Hey (1936) described weddellite (calcium oxalate, $\text{CaC}_2\text{O}_4 \cdot (2 + x)\text{H}_2\text{O}$) and earlandite (calcium citrate, $\text{Ca}_3(\text{C}_6\text{H}_5\text{O}_7)_2 \cdot 4\text{H}_2\text{O}$), collected with gypsum from the Weddell Sea during the Scottish National Antarctic Expedition of 1902–4 in the *Scotia* and picked out by Arthur Earland whilst sorting foraminifera. The metasomatic garnets from the Indian Ocean have already been mentioned, and recent mineralogical research continued with a definitive paper distinguishing between celadonite and glauconite (Buckley *et al.*, 1978), one on variations within glauconite grains (Buckley *et al.*, 1984) and another discussing their rare earth element contents (Fleet *et al.*, 1980).

To summarize, the numbers of papers on oceanographic topics published by members of the Section quinquennially from 1926 to the present are: 1930: 2; 1935: 1; 1940: 3; 1945: nil (war years); 1950: 6; 1955: 16; 1960: 6; 1965: 7; 1970: 3; 1975: 22; 1980: 22 and 1985: 7 – total 95.

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Appendix

The Antarctic Expeditions

It seems appropriate to conclude this account by summarizing the expeditions to the Southern Ocean in which Britain and the countries now in the Commonwealth were the sole or major participants. For, as already stated, the biological and geological collections formed during all but the earliest of them were in most cases subsequently presented to the Museum; the exceptions were generally those in which only limited material was accumulated and subsequently considered to be of no great importance. For this section, very considerable use has been made of the compilation of Dater (1975).

The first Antarctic Expedition (Plate 16 and Table 1) was that of Captain James Cook, leading the *Resolution* and *Adventure* between 1772 and 1775. This was his second southern voyage of discovery and exploration, during which Cook sensed the presence of land near the

Table 1 Antarctic Expeditions with British or Commonwealth Involvement.

Dates	Country – and name	Leader(s)	Ship(s)	Aircraft [A]	Purpose	Principal area(s)	Material collected (if any) in the British Museum (Natural History)
1772–1775	Great Britain	Captain James Cook	<i>Resolution</i> ; <i>Adventure</i>		discovery & exploration	South Georgia; South Sandwich Islands	–
1819	Great Britain	Captain William Smith	<i>Williams</i>		commercial & cargo	South Shetland Islands	–
1819–1820	Great Britain	SM Edward Bransfield, RN	<i>Williams</i>		seek new lands for England	Elephant & Clarence Islands	–
1820–1822	Great Britain	Captain George Powell	<i>Dove</i>		sealing	South Orkney Islands	–
1822–1824	Great Britain	Captains James Weddell & Matthew Brisbane	<i>Jane</i> ; <i>Beaufoy</i>		sealing	Weddell Sea	–
1828–1831	Great Britain	Captain Henry Foster, RN	<i>Chanticleer</i>		scientific investigation	Deception Island	rocks
1830–1832	Great Britain	Captain John Biscoe	<i>Tula</i> ; <i>Lively</i>		sealing & exploration	Graham Land	–
1833–1834	Great Britain	Captain Peter Kemp	<i>Magnet</i>		sealing & exploration	sighted Kemp Coast	–
1838–1839	Great Britain	Captain John Balleny	<i>Eliza Scott</i> ; <i>Sabrina</i>		sealing & exploration	Balleny Islands	–
1839–1843	Great Britain	Captain James Clark Ross, RN	<i>Erebus</i> ; <i>Terror</i>		exploration; magnetic & scientific studies	Graham Land; many islands	many rocks; stomach pebbles; plants
1872–1876	Great Britain	Captain George S. Nares, RN & Prof. C. Wyville Thomson	<i>Challenger</i>		oceanographic studies	wide & various	many dredged rocks & sediments; stomach pebbles; animals; plants
1892–1893	Scotland	Captain Alexander Fairweather & three others	<i>Balaena</i> ; <i>Active</i> ; <i>Diana</i> ; <i>Polar Star</i>		whaling reconnaissance	coastal observation	–
1898–1900	Great Britain	C. E. Borchgrevink	<i>Southern Cross</i>		magnetic & meteorological studies	Victoria Land	many rocks
1901–1904	Great Britain – National Antarctic Expedition	Captain Robert F. Scott, RN	<i>Discovery</i> ; later <i>Morning</i> ; <i>Terra Nova</i>		attempt to reach South Pole	Antarctic continent	many land & dredged rocks
1902–1904	Scotland – Scottish National Antarctic Expedition	Dr William S. Bruce	<i>Scotia</i>		scientific investigation	Weddell Sea	–
1907–1909	Great Britain – British Antarctic Expedition	Lieut. Ernest Shackleton, RNR	<i>Nimrod</i>		attempt to reach South Poles; scientific research	Antarctic continent	many rocks
1910–1913	Great Britain	Captain Robert F. Scott, RN	<i>Terra Nova</i>		attempt to reach South Pole; scientific work in Ross Sea	Antarctic continent; south Victoria Land; Ross Sea	many rocks (historically famous)
1911–1914	Australia & Great Britain – Australasian Antarctic Expedition	Sir Douglas Mawson	<i>Aurora</i>		scientific & geographical research	Wilkes Land	rocks
1913–1914	Scotland	(T. Salvesen)	<i>Hanika</i>		whaling prospecting	South Shetland Islands; Palmer Archipelago; Graham Land	rocks collected by David Ferguson

Year	Organization	Key Personnel	Primary Activities	Geographic Focus	Key Publications	Scientific Contributions	Specimens
1914-1916	Great Britain - British Imperial Trans-Antarctic Expedition	Sir Ernest Shackleton	transcontinental exploration	Antarctic continent			few specimens collected
1920-1922	Great Britain	J. L. Cope	to map coastline of Weddell Sea	Weddell Sea			-
1921-1922	Great Britain	Sir Ernest Shackleton	exploration & mapping	Antarctic continent			rocks
1925-1939	Great Britain - Discovery Investigations	Drs N. A. Mackintosh, Stanley Kemp, D. Dilwyn John, G. E. R. Deacon, H. F. P. Herdman & G. W. Rayner	whale & oceanographical research	wide & various			many land & dredged rocks
1928-1930	USA & Great Britain	Sir Hubert Wilkins	transatlantic flight reconnaissance	various			-
1928-1930	USA - 1st Byrd Antarctic Expedition	Rear-Admiral Richard E. Byrd, USN (Retd)	exploration & scientific investigation	various			rocks collected by L. M. Gould
1929-1931	Great Britain, Australia & New Zealand - British-Australian-New Zealand Antarctic Research Expedition (BANZARE)	Sir Douglas Mawson	scientific & geographical investigation	Antarctic continent & islands			rocks
1934-1937	Great Britain - Graham Land Expedition	John Rymill	scientific investigations & surveying	Graham Land			rocks
1943-1955	Great Britain - Operation Tabarin & Falkland Islands Dependencies Survey	Lieut. Com. J. W. S. Marr & others	long-range scientific & surveying programme, & territorial claim	various			-
1946-1947	Great Britain	Captain Reider Pedersen & John Grierson	whaling & whale reconnaissance, & scientific studies	various			-
1949-1952	Norway, Great Britain & Sweden - Norwegian-British-Swedish Antarctic Expedition	Captain John Giaever	scientific research & surveying	various			-
1954-1955	Australia - Australian National Antarctic Research Expedition	Phillip G. Law	scientific investigation & geographical exploration	various			-
1957-1958	Commonwealth Transantarctic Expedition	Sir Vivian Fuchs	transantarctic crossing	Antarctic continent			rocks

Data from Dater (1975).

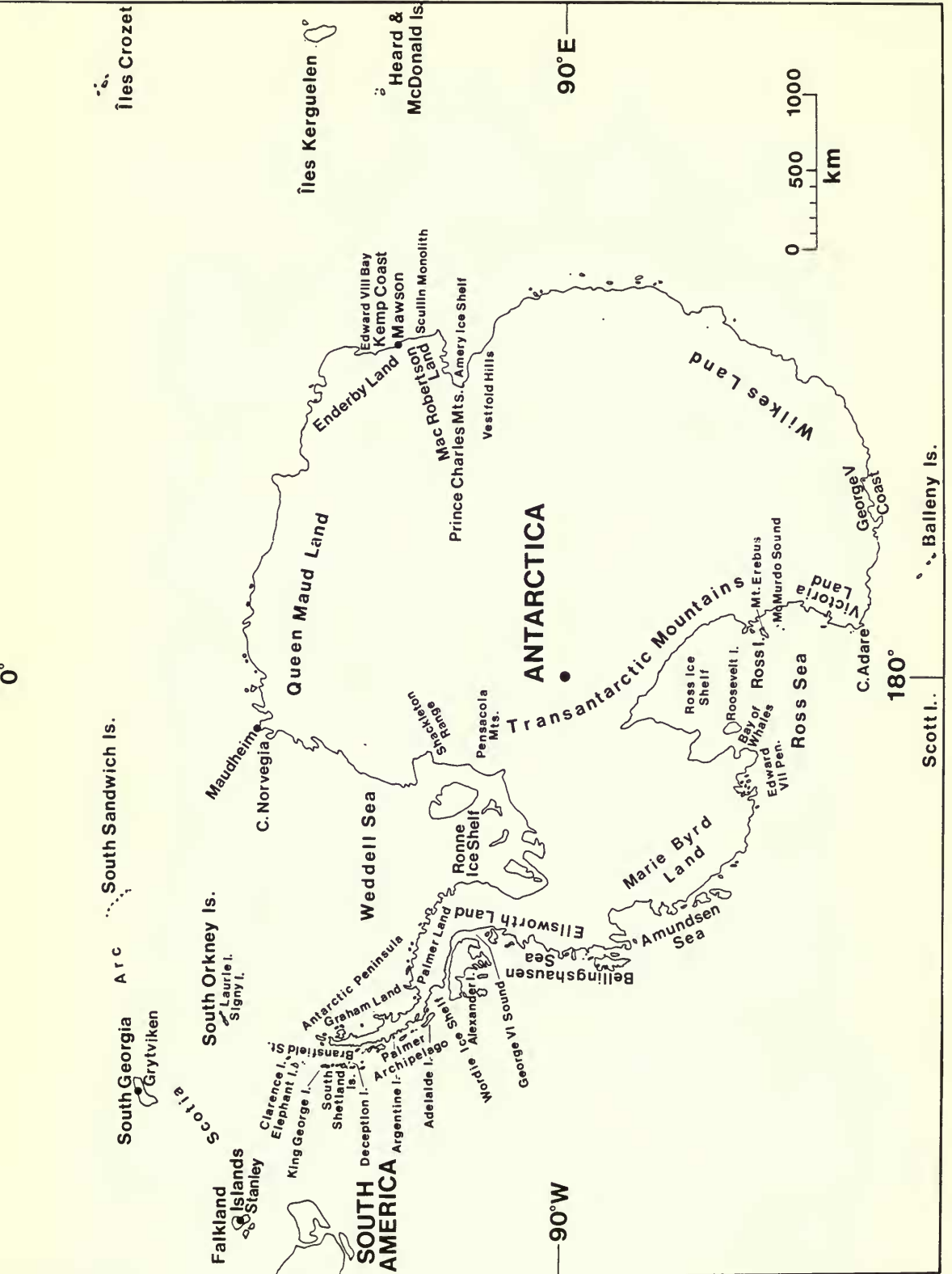


Plate 16 The Antarctic, showing the principal localities visited by the expeditions.

South Pole and made the first landing on South Georgia; he also discovered the southern South Sandwich Islands. In 1819 Captain William Smith, on a commercial cargo voyage in the *Williams*, was blown off course and discovered the South Shetland Islands. Admiralty Sailing Master Edward Bransfield followed, in the same ship, and in 1820 went from the South Shetlands to Trinity Land and on to Elephant and Clarence Islands. Many British, American and other ships now visited the area, amongst them Captain George Powell in the *Dove*, who on his 1820–22 sealing cruise claimed the South Orkney Islands for Great Britain. Seal hunting took Captains James Weddell and Matthew Brisbane, in the *Jane* and *Beaufoy*, to the Antarctic in 1822–24, whilst scientific investigation led Captain Henry Foster, RN, in the *Chanticleer* to follow in 1828–31. Rocks collected by Foster's expedition from Deception Island, and briefly described by Surgeon W. H. B. Webster, RN, are in the Museum's collections (Campbell Smith & Game, 1954: 167–8). Sealing and exploration were the motives for Captain John Biscoe in the *Tula* and *Lively*, and Captain Peter Kemp, in the *Magnet*; Biscoe annexed Graham Land – now the Antarctic Peninsula – in the name of the British Crown. Captain John Balleny, again sealing and exploring, charted the islands named after him – the Balleny Islands – in the *Eliza Scott* and *Sabrina* from 1838 to 1839.

True scientific exploration, sponsored by the Admiralty and the Royal Society, may be said to have begun on a large scale in the Antarctic with the voyage between 1839 and 1843 of the *Erebus* and *Terror*, led by Captain James Clark Ross, RN. Mainly aimed at co-ordinating magnetic observations, and reaching the South Magnetic Pole, the expedition achieved the most southerly penetration to date. It failed to reach the Pole but made countless magnetic and tidal observations and depth soundings. It also made extensive collections of lichens, mosses and marine life, as well as of igneous, sedimentary and metamorphic rocks from Graham Land, Kerguelen, the Auckland Islands, Campbell Island and islands off South Victoria Land. The collection included pebbles from the stomachs of seals and penguins and, although much of it was destroyed, part was successfully bequeathed to the Museum in 1890 by Deputy Inspector-General Robert M'Cormick, RN, who described the geology of the regions visited. Many of the rocks were subsequently described by G. T. Prior (Campbell Smith & Game, 1954; Bishop *et al.*, 1984).

The Antarctic represented only one of the regions visited during the 111110 km circumglobal voyage of HMS *Challenger*, from 1872 to 1876. Again sponsored by the Admiralty, jointly with the Royal Society, this voyage, led by Captain George S. Nares, RN, (latterly Captain F. T. Thomson, RN), and Professor C. Wyville Thomson, aided by John Murray, in effect launched the new science of oceanography as a major discipline. The bulk of the world-wide zoological, botanical and geological collections are in the Museum's scientific departments. The rocks and sediments were mainly dredged from the beds of the oceans, but were occasionally collected from islands. A 20 kg boulder of biotite gneiss was dredged from *Challenger* station 157, at a latitude of nearly 54°S. This, and pebbles of schist and gneiss taken from the stomachs of seals and penguins by Robert M'Cormick during the 1842 voyage of the *Erebus* and *Terror*, might have confirmed the suggestion that an ancient land mass existed at and around the South Pole. However, it was not until almost the turn of the century that examination by G. T. Prior resulted in the realization of their true significance.

An early whaling voyage from Scotland, led in 1892–93 by Captain Alexander Fairweather and others in the *Balæna*, *Active*, *Diana* and *Polar Star*, made limited observations on animal life. The turn of the century was marked by C. E. Borchgrevink in the *Southern Cross*, conducting magnetic and meteorological studies along the coast of Victoria Land from 1898 to 1900. Rocks collected from Possession Island, Coulman Island, Franklin Island and the mainland are in the Museum's collections, presented by Sir George Newnes in 1900 and described by G. T. Prior (Campbell Smith & Game, 1954; Bishop *et al.*, 1984).

Captain Robert F. Scott, RN, led the National Antarctic Expedition of 1901–4, in an attempt to reach the South Pole after determining the extent of the land around it. The rocks collected by his party in their ship RRS *Discovery*, and relief ship *Morning*, sponsored by Government, Royal Geographical Society, Royal Society and others, include material dredged from off the Balleny Islands. Details of the rocks, described by G. T. Prior with an

account of the field geology by H. T. Ferrar, are given by Campbell Smith & Game (1954) and Bishop *et al.* (1984). At much the same time, 1902–4, the Scottish National Antarctic Expedition, led by Dr William S. Bruce in the *Scotia*, was in the Weddell Sea on a scientific voyage.

In 1907–9, led by Lieut. Ernest Shackleton, RNR, the British Antarctic Expedition in the *Nimrod* followed the Scott expedition in an attempt to reach the magnetic and true South Poles and conduct scientific investigations. Various igneous, metamorphic and sedimentary rocks were collected from different areas of South Victoria Land and the Ross Archipelago (Campbell Smith & Game, 1954; Bishop *et al.*, 1984). Captain Scott's second expedition, in the *Terra Nova*, 1910–13, reached the South Pole only to find that the Norwegian Roald Amundsen, in the *Fram*, had beaten him. Scott's party completed extensive scientific work in the Ross Sea area, supported again by the Royal Society, and collected sediments and extensively from the rocks of South Victoria Land, especially the Ross Island–McMurdo Sound–Cape Adare areas; many of these rocks were described by W. Campbell Smith (Campbell Smith & Game, 1954; Bishop *et al.*, 1984). Now in the Museum's collection, they are amongst its most historically famous specimens; frequently exhibited, they support the scientifically valuable geological observations made in South Victoria Land (Moore, 1982).

Australia and Great Britain combined from 1911 to 1914 in the Australasian Antarctic Expedition, led by Sir Douglas Mawson, in the *Aurora*. The expedition was mounted for scientific and geographical research along the coast of Wilkes Land; igneous and metamorphic rocks collected from the Cape Denison area are in the Museum (Bishop *et al.*, 1984). In 1913–14, a whaling prospecting expedition set out from Scotland in the *Hanka*. During their operations in the South Shetlands, Palmer Archipelago and Graham Land, David Ferguson collected many rock specimens, subsequently described by G. W. Tyrell; some of these are now in the Museum (Campbell Smith & Game, 1954; Bishop *et al.*, 1984). Together with the *Endurance*, the *Aurora* featured again in the British Imperial Trans-Antarctic Expedition, led by Sir Ernest Shackleton. This was a government and Royal Geographical Society backed transcontinental exploration expedition. Little scientific work was carried out but some specimens were collected.

Whaling ships under J. L. Cope formed the first British expedition of the 1920s. Their objective was to map the Weddell Sea coastline; in this they were not successful but some scientific work was undertaken. In 1921–22, Sir Ernest Shackleton, sponsored by John Q. Rowett, returned to the Antarctic in the tiny *Quest*. Their purpose was to explore and map; unfortunately the ship was not up to it and Shackleton died from heart disease in January 1922, his place being taken by Frank Wild. Rocks collected on this voyage by Dr G. Vibert Douglas from South Georgia, the South Sandwich Islands and the South Shetlands Islands, and dredged from the Weddell Sea, are in the Museum's collections. Some specimens were briefly described (Campbell Smith & Game, 1954; Bishop *et al.*, 1984; Moore, 1982).

The period between 1925 and 1939 saw the initiation and operation of the Discovery Investigations. In 1923 the Discovery Committee had been established, set up by the British Colonial Office to promote oceanographic research in the region of the Falkland Islands. Initiated in 1904, the Falkland Islands Dependencies Survey was renamed in 1918 the 'Interdepartmental Committee for the Dependencies of the Falkland Islands'; it later became the British Antarctic Survey. A group of scientists, led by Drs N. A. Mackintosh, Stanley Kemp, D. Dilwyn John, G. E. R. Deacon, H. F. P. Herdman and G. W. Rayner, made repeated voyages to the Antarctic in the RRS *Discovery*, *Discovery II* and *William Scoresby* (Plates 17–20). Their purpose: oceanographical research, following the *Challenger* voyage of some 60 years before, with the results to be published from Cambridge in the *Discovery Reports* (Deacon, 1984). The focal point of the research was to be the biological and physical conditions affecting the distribution of whales, the primary interest of the leader of the first expedition, N. A. Mackintosh. Work was extended to include the study of krill, naturally; also of elephant seals; bird life; and, ashore, lichens, mosses and algae. Many geological specimens were collected including dredged rocks, which were studied by C. E. Tilley and G. W. Tyrell, and subsequently by Kempe (1973). Together with the acquisition of the *Challenger* collection,



Plate 17a RRS *Discovery*.

the establishment of part of the Discovery Investigations – The Whale Research Unit – in the ‘Discovery Hut’ in the grounds of the British Museum (Natural History) was the second major event leading to the initiation of oceanographical research in the Museum. The Whale Research Unit in 1950 became part of the newly founded National Institute of Oceanography, later to become the Institute of Oceanographic Sciences, but was subsequently transferred, in 1977, to the Sea Mammals Research Unit, British Antarctic Survey, in Cambridge.



Plate 17b RRS *Discovery* in 1985, being restored and open to the public in St Katharine's Dock, City of London; she is now in Dundee, where she was originally built.

From 1928 to 1930, Britain joined forces with the United States of America in an expedition planned to pioneer transatlantic flight and aerial reconnaissance. The leader was Sir Hubert Wilkins and the *William Scoresby* was used to transport the expedition southwards. At the same time, the US 1st Byrd Antarctic Expedition, under Rear-Admiral R. E. Byrd, USN (Retired), was under way and the Museum acquired some rocks collected by L. M. Gould from the Queen Maud Mountains (Campbell Smith & Game, 1954; Bishop *et al.*, 1984).

BANZARE: the British-Australian-New Zealand Antarctic Research Expedition, led by Sir Douglas Mawson, used the RRS *Discovery* from 1929 to 1931 on a scientific and geographic expedition to Crozet, Kerguelen and Heard Islands; the coast of Enderby and MacRobertson Land; and the Balleny Islands. Rocks from some of these localities are in the Museum's collections (Bishop *et al.*, 1984). The last of the pre-war British expeditions took place in 1934–37: the British Graham Land Expedition, led by John R. Rymill in the *Penola*. A small scientific and surveying expedition, it collected rocks from the Graham Land coast and nearby islands, which are now in the Museum (Campbell Smith & Game, 1954; Bishop *et al.*, 1984).

After the Second World War, British bases were set up at, among other localities, Deception Island in the South Shetlands and Signy Island in the South Orkneys. A scientific and surveying programme was carried out between 1943 and 1955, led by Lieut. Com. J. W. S. Marr and others, in the ships *William Scoresby*, *Fitzroy*, *Eagle*, *Trepassey* and *John Biscoe*, under the title Operation Tabarin and Falkland Islands Dependencies Survey; in 1962 it became the British Antarctic Survey. Within this period, a whaling expedition, prompted by the worldwide shortage of fats, was carried out in the *Balæna*, with two Walrus seaplanes, from 1946 to 1947, under Captain Reider Pedersen and John Grierson.

Britain participated from 1949 to 1952 in a scientific survey by the Norwegian-British-Swedish Antarctic Expedition in the *Norsel*, led by Captain John Gjaever. Another scientific



Plate 18 RRS *William Scoresby*.

and geographical exploration expedition was the Australian National Antarctic Research Expedition, led by Phillip G. Law, from 1954 to 1955. The voyage, in the *Kista Dan*, followed up the establishment in 1947–48 of bases on Heard and Macquarie Islands by a group in the *Wyatt Earp*; this ship, however, was prevented by pack-ice from reaching the George V coast. The *Kista Dan*, an ice breaker, succeeded in reaching the MacRobertson Land coast and set up the station at Mawson.

This survey of British and Commonwealth Antarctic expeditions can be closed appropriately with the Commonwealth Transantarctic Expedition which crossed from Shackleton to Scott Base, via the South Pole, between January and March 1958, under the leadership of Sir Vivian Fuchs. Rocks collected on this crossing were presented to the Museum in 1977 by the British Antarctic Survey, while research activities by the British, Americans and Australians, to name but a few, had become routine and widespread.

Other Oceanic, Biological Expeditions

In addition to the expeditions to Antarctica leading, generally, to acquisitions of geological material by the Museum, there are, of course, a number of well-known biological expeditions which made collections of zoological and botanical specimens. Many of these also have been donated to the Museum.



Plate 19 RRS *Discovery II*.

Notes

The letters and official documents quoted or cited in the text are all held in the British Museum (Natural History). Their locations are identified by the following:

MA/ Museum Archives.

MA(M)/ Museum Archives, Department of Mineralogy records.

MA(Z)/ Museum Archives, Department of Zoology records.

ML/ Murray Library, Palaeontology and Mineralogy Library.

1. Notes on the life of Sir John Murray compiled by J. D. H. Wiseman, 16 June 1972, for the BM(NH) *Challenger* Centenary Exhibition. ML/
2. Letter, 8 April 1914, J. Chumley to E. Heron-Allen; MA(Z)/OD 1914 f. 87B.
3. Letter, 9 April 1914, E. Heron-Allen to L. Pullar; MA(Z)/OD 1914 f. 87B.
4. Letter, 10 April 1914, L. Pullar to E. Heron-Allen; MA(Z)/OD 1914 f. 87B.
5. Report on the Oceanographical Collections formed by Sir John Murray at the Villa Medusa, Edinburgh, by E. Heron-Allen and A. Earland; ML/187 f. 1–28.
6. Letter, 12 June 1919, Lady Murray to Sir F. Harmer, Director; ML/198 f. 2.
7. Letter, 7 June 1919, Director to Lady Murray; MA(Z)/OL 1919 f. 152.
8. Letter, 15 June 1919, J. C. Murray to Director; ML/198 f. 3.
9. Letter, 20 June 1919, Director to J. C. Murray; MA(Z)/OL 1919 f. 173.
10. Letter, 10 July 1919, J. C. Murray to Director; ML/198 f. 5.
11. Letter, 26 November 1919, J. C. Murray to Director; ML/198 f. 9.
12. Report to Trustees, 14 November 1919, by Director; ML/199 f. 1.
13. Letter, 22 November 1919, Director to J. C. Murray; MA(Z)/OL 1919 f. 279.
14. Letter, 4 December 1919, Director to J. C. Murray; MA(Z)/OL 1919 f. 289.



Plate 20 RRS *Discovery II* at Sandefjord Bay, Coronation Island, South Orkney Islands, 1937.

15. Report to Trustees, 19 January 1920, by Director; MA/DF 1004/CP 227 f. 88–95.
16. Internal memorandum, 23 December 1919, C. Tate Regan to Director; MA(Z)/IL 1920 f. Murray 1.
17. Letter, 4 January 1920, Lady Murray to Director; ML/198 f. 10.
18. Internal memorandum, 10 January 1920, Director to A. Smith Woodward; MA(Z)/IL 1920 f. Murray 2.
19. Reply on same memorandum, A. Smith Woodward to Director; MA(Z)/IL 1920 f. Murray 2.
20. Letter, 12 January 1920, J. H. Ashworth to Director; MA/DF 1004/CP 227 f. 96–8.
21. Report of Standing Committee, 24 January 1920; MA/DF 1004/CP 227 f. 35–9.
22. Letter, 20 January 1920, J. C. Murray to C. E. Fagan; ML/198 f. 11.
23. Letter, 30 January 1920, Director to Lady Murray; MA/DF 1001/56 f. 620–1.
24. Letter, 31 January 1920, Lady Murray to Director; ML/198 f. 12.
25. Letter, 2 February 1920, J. C. Murray to Director; ML/198 f. 13.
26. Letter, 4 February 1920, J. C. Murray to Director; ML/198 f. 14.
27. Letter, 18 March 1920, J. C. and T. H. Murray to Director; MA/DF 1004/CP 227 f. 33.
28. Report to Trustees, 24 March 1920; MA/DF 906/SC f. 3702.
29. Letter, 29 April 1920, C. E. Fagan to J. C. Murray; MA/DF 1004/CP 227 f. 31.
30. Letter, 12 March 1920, Harvard University to J. C. Murray; MA(Z)/IL 1920–25 f. Murray 1a.
31. Letter, 14 October 1921, Director to J. C. Murray; MA/DF 967/File 1 f. 147.
32. Report to Trustees, 16 October 1926; MA/DF 1004/CP 227 f. 41–2.
33. Memorandum, 12 August 1920, Office of Works to C. E. Fagan; MA(Z)/OD 1920 f. 134.
34. Memorandum, 9 September 1920, Office of Works to Director; MA/DF 1004/CP 227 f. 75.
35. Report to Trustees, 20 October 1920; MA/DF 1004/CP 227 f. 72–4.
36. Memorandum, 1 December 1920, Office of Works to Director; MA(Z)/OD 1920 f. 189.
37. Memorandum, 22 December 1920, Office of Works to Director; MA(Z)/OD 1920 f. 206.
38. Memorandum, 31 January 1921, Office of Works to Director; MA(Z)/OD 1921 f. 23.

39. Letter, 31 January 1921, Director to J. C. Murray; MA(Z)/OD 1921 f. 24.
40. Letter, 7 March 1921, J. C. Murray to Director; MA(Z)/OD 1921 f. 52.
41. Letter, 16 March 1921, Director to Graham Kerr; MA(Z)/OD 1921 f. 55.
42. Letter, 9 April 1921, Graham Kerr to Director; MA(Z)/OD 1921 f. 63.
43. Letter, 18 April 1921, Director to Graham Kerr; MA(Z)/OD 1921 f. 64.
44. Letter, 20 April 1921, J. Chumley to Director; MA(Z)/OD 1921 f. 67a.
45. Internal memorandum, 21 April 1921, Director to C. Tate Regan; MA(Z)/OD 1921 f. 67.
46. Internal memorandum, 25 April 1921, C. Tate Regan to Director; MA(Z)/OD 1921 f. 67.
47. Letter, 28 April 1921, Director to J. C. Murray; MA/DF 1004/CP 227 f. 29.
48. Internal memorandum, 18 July 1921, C. Tate Regan to Trustees; MA/DF 1004/CP 227 f. 63.
49. Letter, 26 July 1921, C. Tate Regan to J. C. Murray; ML/201 f. 1.
50. Letter, 29 July 1921, J. C. Murray to W. T. Calman; ML/201 f. 2.
51. Internal memorandum, 13 October 1921, C. Tate Regan to Trustees; MA/DF 1004/CP 227 f. 58.
52. Letter, 14 October 1921, Director to J. C. Murray; MA/DF 967/File 1 f. 147.
53. Internal memorandum, 18 October 1921, C. Tate Regan to W. T. Calman; ML/201 f. 10.
54. Letter, 15 November 1921, Director to J. C. Murray; MA/DF 1004/CP 227 f. 49.
55. Letter, 17 November 1921, H. G. Lyons, Director, Science Museum, to Director; ML/202 f. 1.
56. Letter, 22 November 1921, H. G. Lyons to Director; ML/202 f. 2.
57. Letter, 23 November 1921, H. G. Lyons to Director; ML/202 f. 3.
58. Internal memorandum, 19 December 1921, G. T. Prior to W. T. Calman; ML/202 f. 4.
59. Internal memorandum, 23 December 1921, G. T. Prior to W. T. Calman; ML/202 f. 5.
60. Memorandum, 28 June 1922, P. R. Lowe to C. Tate Regan; ML/202 f. 6.
61. Letter, 27 June 1922, Director to Messrs Davidson and Syme; MA/DF 1004/CP 227 f. 46.
62. Letter, 17 October 1921, Director to J. Stanley Gardiner; MA/DF 1004/CP 227 f. 53.
63. Letter, 22 October 1921, J. Stanley Gardiner to Director; MA/DF 1004/CP 227 f. 52.
64. Internal memorandum, 25 October 1921, Director to F. A. Bather; MA/DF 1004/CP 227 f. 51.
65. Reply (no date) on same memorandum, F. A. Bather to Director; MA/DF 1004/CP 227 f. 51.
66. Letter, 26 October 1921, Director to R. Dykes; MA/DF 1004/CP 227 f. 50.
67. Letter, 19 May 1932, J. Stanley Gardiner to Trustees; MA/DF 1004/CP 367 f. 36–8.
68. Letter, 3 June 1932, C. Tate Regan, Director, to J. Stanley Gardiner; MA/DF 1004/CP 367 f. 35.
69. Letter, 20 June 1933, J. C. Murray to Director; MA/DF 1004/CP 367 f. 34.
70. Letter, 29 June 1933, Director to J. C. Murray; MA/DF 1004/CP 367 f. 33.
71. Letter, 22 October 1934, J. C. Murray to Director; MA/DF 1004/CP 367 f. 30–1.
72. Letter, 13 November 1934, Director to J. C. Murray; MA/DF 1004/CP 367 f. 27.
73. Letter, 21 June 1939, Director to Sir S. Gaselee; MA/DF 1004/CP 367 f. 10.
74. Letter, 13 July 1939, Sir S. Gaselee to Museum Secretary; MA/DF 1004/CP 367 f. 9.
75. Letter, 18 September 1939, Sir S. Gaselee to Museum Secretary; MA/DF 1004/CP 367 f. 8.
76. Internal memorandum, 14 December 1949, Keeper of Zoology to Secretary; MA/DF 1004/CP 367 f. 6.
77. Letter, 27 July 1934, J. C. Murray to J. Stanley Gardiner; MA/DF 1004/CP 227 f. 26.
78. Letter, 30 July 1934, J. Stanley Gardiner to Director; MA/DF 1004/CP 227 f. 27.
79. Letter, 13 August 1934, Director (for Trustees) to Treasury; MA/DF 1004/CP 227 f. 24–5.
80. Letter, 18 September 1934, Treasury to Trustees; MA/DF 1004/CP 227 f. 23.
81. Letter, 11 March 1935, J. Stanley Gardiner to Director; MA/DF 1004/CP 367 f. 22.
82. Report, 18 November 1935, G. F. Herbert Smith to Trustees; MA/DF 1004/CP 227 f. 15–16.
83. Letter, 28 November 1935, Director to Bernard Smith; MA/DF 1004/CP 227 f. 14.
84. Internal memorandum, 23 June 1936, Director's Office to G. F. Herbert Smith; MA/DF 1004/CP 227 f. 9–10.
85. Report, 25 July 1936, G. F. Herbert Smith to Trustees; MA/DF 906/SC f. 50, 62.
86. Internal memorandum, 10 April 1937, G. F. Herbert Smith to Director; MA/DF 1004/CP 367 f. 13.
87. Report, 17 April 1937, G. F. Herbert Smith to Trustees; MA/DF 1004/CP 367 f. 12.
88. Internal memorandum, 22 November 1937, W. Campbell Smith to Director; MA/DF 1004/CP 227 f. 8.
89. Internal memorandum, 23 November 1937, Director to W. Campbell Smith; MA/DF 1004/CP 227 f. 7.
90. Letter, 16 February 1944, Sir J. A. Edgell, Hydrographer of the Navy, to J. D. H. Wiseman; MA(M)/DF 28 f. 92.
91. Letter, 3 March 1944, Hydrographer to J. D. H. Wiseman; MA(M)/DF 28 f. 91.
92. Proposal for National Oceanographic Institute, summary by G. E. R. Deacon; MA(M)/DF 28 f. 93–5.

93. Letter, 21 June 1944, J. D. H. Wiseman to J. N. Carruthers; MA(M)/DF 28 f. 78–9.
 94. Proposals on the work of the new National Oceanographic Institute; MA(M)/DF 28 f. 76–7.
 95. Memorandum, 20 March 1944, J. R. Lumby to Hydrographer; MA(M)/DF 28 f. 85.
 96. Memorandum, 5 July 1944, to Hydrographic Department, Bath; MA(M)/DF 28 f. 63.
 97. Letter, 5 August 1944, J. D. H. Wiseman to Hydrographer; MA(M)/DF 28 f. 55–7.
 98. Letter, 24 November 1947, D. C. Martin to J. D. H. Wiseman; MA(M)/DF 28 f. 36.
 99. Royal Society Communication NGG/7(47), 10 December 1947; MA(M)/DF 28 f. 32.

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